**Weekly Summary**
Economics of Climate Change
October 25, 2024

The green job puzzle: how alternative definitions shape the analysis

Green jobs play a pivotal role in decarbonizing economies, yet their precise definition varies depending on the question to be answered. Understanding their evolution across activities, products, and skills & tasks becomes crucial for the design and deployment of the most appropriate policies.

The definition of green jobs depends on the policy question to answer. Green jobs, broadly speaking, encompass labor roles that contribute to preserving or restoring environmental quality. These positions can involve activities aimed at reducing waste, lowering emissions, or using resources more efficiently. However, a more precise definition of what constitutes a "green job" varies based on the approach used to measure it (**Figure 1**). The choice ultimately depends on the policy objective, whether it's assessing the labor market's weight in current decarbonization, identifying sectors impacted by climate policies, or understanding the potential for job creation in green industries.[1]



Figure 1. **DEFINING GREEN JOBS. ALTERNATIVE APPROACHES**
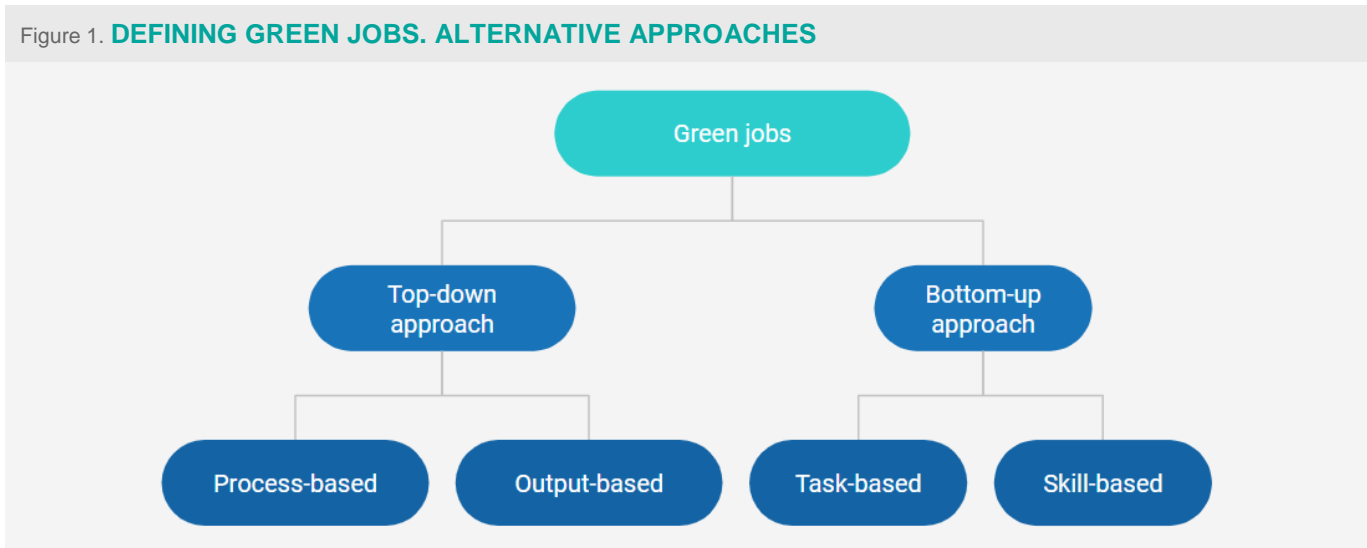
Source: BBVA Research from Job Creation and Local Economic Development 2023 | OECD.

1: In recent years, significant progress has been made in defining and studying green jobs, with a substantial number of academic and applied analysis; among others:
- CEPS, 2023: JOBS FOR THE GREEN TRANSITION
- EC, 2022: The Crosswalk between ESCO and O*NET
- EC, 2024: Assessing Green Job Dynamics in the EU: A Comparison of Alternative Methodologies
- IMF, 2022: Transitioning to a Greener Labor Market: Cross-Country Evidence from Microdata
- OECD, 2023: Job Creation and Local Economic Development 2023 : Bridging the Great Green Divide
- OECD, 2024: OECD Employment Outlook 2024: The Net-Zero Transition and the Labour Market

Top-down methodologies classify green jobs based on the characteristics of sectors or industries that are either producing environmental goods and services or integrating environmentally friendly practices. This includes the output-based definition, where jobs are considered green if they produce goods or services beneficial to the environment or aimed at conserving resources, and the process-based definition, which considers production methods that incorporate eco-friendly technologies or practices. Following this approach, the Environmental Goods and Services Sector (EGSS) by Eurostat includes workers engaged in activities that either protect the environment or manage natural resources.[2] The advantage of this methodology is its straightforward interpretation, especially if the objective is industrial analysis, but the approach is affected by sectoral structure and leads to conservative estimates of green employment. In Spain, the share of green jobs based on this approach was around 2.6% in 2021, slightly smaller than in the EU (2.8% in 2021), but the gap is steadily narrowing (**Figure 2**). Notably, most of these green jobs in Spain (60%) are found within two sectors: Water supply, sanitation activities, and waste management (26,2% in 2022) and Construction (34,5%) (**Figure 3**).[3]

Figure 2. **SHARE OF EMPLOYMENT IN THE ENVIRONMENTAL GOODS AND SERVICES SECTOR** (EGSS) (%)
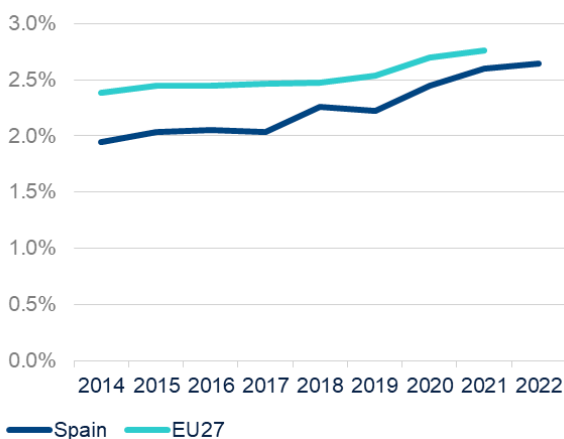
Source: BBVA Research from Eurostat.

Figure 3. **SECTORAL COMPOSITION OF EGSS EMPLOYMENT IN SPAIN** (2022, %)
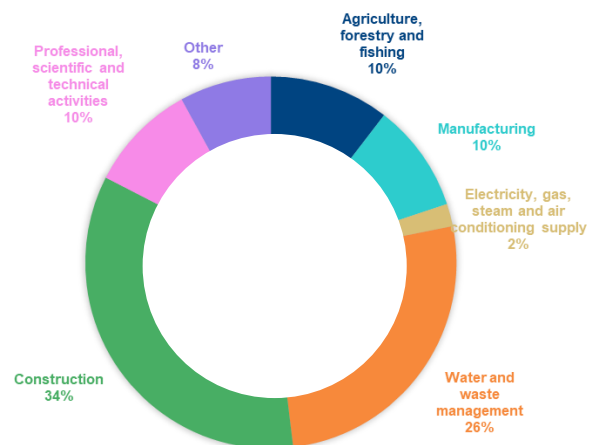
Source: BBVA Research from INE.

In contrast, bottom-up approaches focus on the specific characteristics of occupations, regardless of the sector in which they are found. These task-based measures identify green jobs by analyzing the nature of the tasks performed within each occupation. The most widely used framework is O*NET, a comprehensive database that provides descriptions of tasks and skill requirements for around 1,000 occupations in the U.S. labor market. Dierdorff et al. (2009) have complemented O*NET with a taxonomy of green occupations into three groups: "green new and emerging occupations," "green-enhanced skills occupations," and "green increased demand occupations." This classification helps to reveal that the differences in green employment across countries are relatively small, both in terms of magnitude and composition (**Figure 4**).[4] More recently, Vona et al. (2018) proposed a narrower

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2: For reference: Glossary:Environmental goods and services sector (EGSS) - Statistics Explained.
3: At the domestic level, an alternative top-down measure is made as part of the "Perfil Ambiental", whose characterization defines the number of employees in sectors considered to be part of the "green economy", including 61 activities within 10 sectors. Under this measure, it represents 10% of the total employment, with a relatively stable trend in the last 10 years. For details regarding the included CNAE activities:
https://www.miteco.gob.es/content/dam/miteco/es/ministerio/servicios/informacion/pae/PAE2022_apendice1.pdf
4: See "Box 2.3 The O*NET database" in The jobs that will make the net-zero transition: Who holds them and are they good? OECD Employment Outlook 2024

definition of green jobs calculating a green task intensity on the previously identified occupations, providing a more granular view of what is known as "green intensity" for different roles, which lowers the estimates (**Figure 5**).[5]

An alternative to the O*NET occupational database is the ESCO framework, based on occupational data within Europe[6], which incorporates green labeling based on the specific skills required for different occupations, classifying them as green when relevant. In both systems, a threshold can be applied to determine whether a job qualifies as green, based on the proportion of green skills or tasks. For example, over a 10% threshold of green content within an occupation, O*NET identifies 11 occupations (at the ISCO 3-D level) as green, while ESCO identifies 15.[7] Despite some methodological differences, the magnitude of green-labeled occupations is comparable between the two systems, representing approximately 7.5% of EU27 employment in 2022 according to ONET's methodology and 7.1% under ESCO (European Commission, 2024) (**Figure 5**).

However, one distinction is that ESCO tends to emphasize lower-skilled jobs, particularly in agriculture, whereas O*NET focuses more on technical and managerial roles within the green economy. Following the ESCO-based methodology, agriculture and manufacturing become central in green employment (together making up more than half of green jobs). 'Other sectors' also play a significant role, particularly driven by food & accommodation, administrative and support service activities, and public administration. Following the O*NET-based methodology, 65% of green jobs are in manufacturing, construction, and professional services. In other words, while the ESCO-based methodology underlines the green character of jobs in agriculture, the O*NET-based methodology puts more emphasis on green service jobs, covering around 50% of all green jobs (**Figure 5**).

Figure 4. **SHARE AND COMPOSITION BY TYPE OF GREEN-DRIVEN OCCUPATIONS** (%, AVERAGE 2015-2019). O*NET
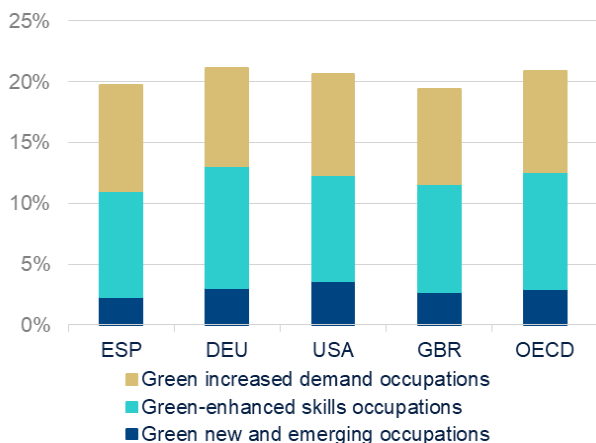
Notes: O*NET-based methodology.
Source: BBVA Research from OECD 2024.

Figure 5. **SECTORAL DISTRIBUTION OF GREEN JOBS EU27** (%, 2022)
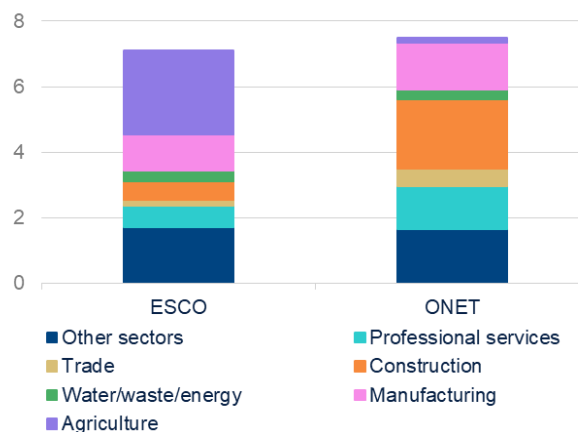
Source: BBVA Research from European Commision 2024.

5: According to Vona et al. (2018) green jobs are jobs that are identified by Dierdorff et al. (2009) as relating to the green economy and include green task content.
6: This classification could also reduce the possible mismatches in the crosswalk from the occupations in the American and the European labor markets.
7: If, instead of applying thresholds to define an occupation as green, a continuous approach is used based on the occupation's green intensity, the overall share of green employment would decrease. This is because only the portion of each occupation's green tasks would count toward green employment, rather than classifying the entire occupation as green. For example, in the case of O*NET, this would reduce the share from 7.5% to 2.4%.

Box 1. Brown jobs

While green jobs are on the rise, the green transition also has significant implications for so-called **"brown jobs"** -those in industries that have a high environmental impact due to their pollution intensity. These jobs, concentrated in sectors like mining, heavy manufacturing, and certain agricultural activities, are likely to face declining demand as countries push towards decarbonization. High-emission industries are significant contributors to greenhouse gas emissions but in terms of employment they represent a relatively small share of the workforce in Spain and the majority of EU countries. For instance, while 80% of emissions were concentrated within 8 sectors, it only accounted for 9.4% of the total employment in Spain in 2022 (**Figure B1**). According to the economic activities with the highest greenhouse gas emissions per worker in the EU27[8], these jobs are experiencing a declining trend. In 2023, they employed 6.4% of the total employment in Spain, of which 3.7% were found in the primary sector (crop and animal production) (**Figure B2**).

Figure B1.1 **RELATIONSHIP EMISSIONS AND EMPLOYMENT IN SPAIN** (%, 2022)
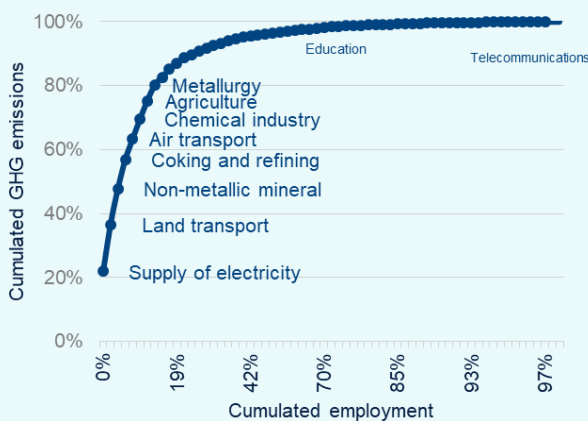
Source: BBVA Research from INE.

Figure B1.2. **EVOLUTION OF BROWN-JOBS IN SPAIN** (%)
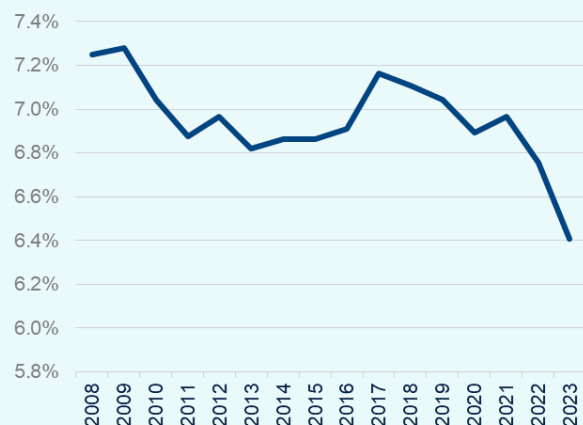
Source: BBVA Research from INE.

The transition to a green economy will have important implications for the labor market, particularly in terms of evolving skill demands and wage dynamics. While the overall net employment effects may be modest, the impact will vary significantly across industries, occupations, and regions (See **Box 2. Implications for the labor market: Transitions, skills and wages**). As highlighted, the definition of green jobs plays a critical role not only in determining the scale of these changes but also in shaping how the transitions unfold. Depending on whether green jobs are defined by sectors, processes, or tasks, the workforce transition could look very different in terms of the qualifications and skills required. A broader definition might capture more jobs but overlook the depth of skill transformation needed, while a narrowly defined task-based approach may better reflect the specific competencies necessary for a low-carbon future.


8: The selected sectors were: Fishing and aquaculture, Crop and animal production, Mining and quarrying, Manufacture of chemicals and chemical products, Manufacture of basic metals, Sewerage, waste collection & treatment, remediation activities, Manufacture of other nonmetallic mineral products, Air transport, Water transport, Electricity, gas, steam and air conditioning supply, Manufacture of coke and refined petroleum products, according to the description in The Possible Implications of the Green Transition for the EU Labour Market.

Box 2. Implications for the labor market: Transitions, skills and wages

The employment transition from brown to green jobs is small overall, but growing. For workers in pollution-intensive jobs to move to a green job is challenging, with a probability between 4-7% (IMF, 2022)[9]. By industry, the probability of transitioning to a green job is 1.24% in utilities (% of transitions to clean jobs by industry), 0.42% in construction and 0.39% in manufacturing. Also younger workers are more likely to transition from a 'brown' job to a 'green' job (Curtis et.al, 2024). Manufacturing, which stands out in the share of both green and brown-task jobs, will play a critical role in the green transition. While in aggregate terms the employment effects are likely to be small (with the creation of new 'green' jobs at the cost of 'brown' jobs under pressure), many neutral or 'white' jobs[10] will be affected through the adoption of more environmentally friendly work practices.

Following a bottom-up approach for instance, it is found that high-skilled workers and those who live in cities tend to have more green-intensive and less polluting jobs (**Figure B3**). In terms of wages, on average green-intensive job wages are higher than pollution-intensive jobs[11], although low-skill green-driven jobs tend to have worse job quality (OECD, 2024). Hence, the job-quality of green-driven occupations is largely driven by the higher levels of education and experience requirements, while polluting jobs are dominated by workers with lower educational attainment.

Figure B2.1 **ENVIRONMENTAL PROPERTIES OF JOBS BY WORKER** CHARACTERISTICS (AVERAGE INDIVIDUAL INDEX; CO2 TONS PER WORKER FOR EMISSIONS)

■ Higher-skilled ■ Lower-skilled ■ Rural ■ Urban
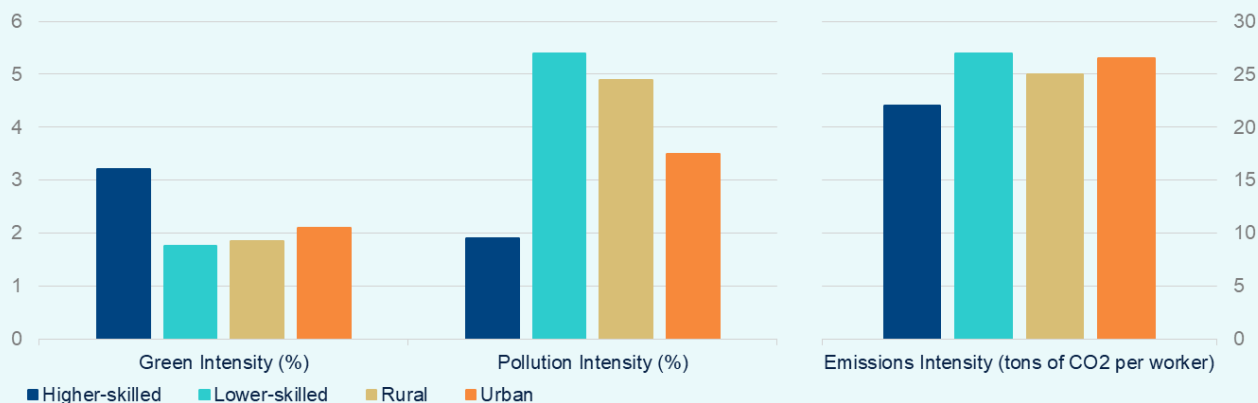
Source: BBVA Research from Transitioning to a Greener Labor Market: Cross-Country Evidence from Microdata | IMF 2022.

Overall, as green sectors and jobs are expected to grow, economic and distributional impacts will manifest unevenly across sectors and skill levels, with the potential for negative effects to be exacerbated by labor market frictions during job reallocation. Even if the effects on employment are small at the national level, it has strong implications at the local level. Hence, policy support to smooth the transition is crucial. More stringent environmental sustainability policies support the green intensity of newfound occupations, as well as lower average

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9: Probabilities are calculated based on transitions across three job types among individuals switching jobs (panel data). For the discrete state transition probabilities exhibited in this figure, a job is defined to be green-intensive if its green intensity is positive and its pollution intensity is zero; likewise, a job is defined to be pollution-intensive if its pollution intensity is positive and its green intensity is zero. A job is defined to be neutral if its green and pollution intensities are both zero. See Online Annexes 3.1 and 3.4 for details on the sample and estimation.
10: 'White' jobs are defined as those with a low pollution intensity, but no specific green task content (European Commission, 2022).
11: Controlling by skills, green-intensive jobs exhibit an earning premium of 7%, on average, with respect to those in pollution-intensive jobs (IMF, 2022). The wage premium is estimated to be around 20% of green-task jobs over polluting jobs according to OECD (2023), although this higher percentage could be partly due to education, experience and lack of supply factors.

emissions intensity of these positions[12]. This should go in-hand with investments in education and training to obtain the necessary technical skills (and even upskill), at the same time as ensuring inclusive social protection systems. However, there is still progress to be made in defining and studying green jobs, with a need for consensus on their definition to better analyze their evolution and impact.[13] Nowadays, the literature suggests that the prevalence, the evolution, and the distribution of green jobs are strongly determined by how green jobs are defined and measured.

Highlights of the Week

◢ **Global | Nations must close huge emissions gap in new climate pledges and deliver immediate action, or 1.5°C lost.**
- It is still technically possible to meet the 1.5°C goal, but only with a G20-led massive global mobilization to cut all greenhouse gas emissions, starting today
- Continuation of current policies will lead to a catastrophic temperature rise of up to 3.1°C
- Current commitments for 2030 are not being met; even if they are met, temperature rise would only be limited to 2.6-2.8°C

◢ **Global | Developed countries failing to pay 'fair share' of nature finance ahead of COP16 - Carbon Brief**. The majority of developed countries are paying less than 50% of their "fair share" towards biodiversity finance, according to new analysis.

◢ **Global | What the data centre and AI boom could mean for the energy sector – Analysis - IEA.** There is an urgent need for public-private dialogue, with policymakers, the tech sector and the energy industry coming together for discussions. The promises of AI are real – not least for clean energy innovation. But delivering responsible AI will require new partnerships to quickly emerge.

◢ **Colombia | The forest, a lever for sustainable development in Colombia | BBVA Research**. Deforestation in Colombia is unsustainable environmentally, economically, and socially. Reversing it requires strengthening land ownership and usage systems, promoting sustainable development, and assigning value to natural assets. Coordination between public policies and the private sector is essential.

12: In addition, environmental policies are more effective in reducing the pollution intensity of employment if there are coordinated labor markets and collective bargaining agreements (IMF, 2022).
13: The European Commission is working on improving the statistical capacity and the understanding of methodological challenges to facilitate the identification of green jobs going forward. Major efforts are going on in this regard as part of the "GreenJobs" project, for which results will be available soon.

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